

This listing of claims will replace all prior versions,
and listings, of claims in the application:

1 Claim 1 (currently amended): Apparatus for use in a mobile
2 user unit in an orthogonal frequency division multiplexing
3 (OFDM) based spread spectrum multiple access wireless
4 system including at least two adjacent base stations, each
5 one of the adjacent base stations transmitting pilot tones
6 according to one of a plurality of different pilot tone
7 hopping sequences over at least a portion of a pilot
8 sequence transmission time period, said portion including
9 multiple symbol time periods, at least one of the different
10 pilot tone hopping sequences including at least two pilot
11 tones per symbol time period which are separated from one
12 another by at least one tone during said portion of said
13 pilot sequence transmission time period, in each of the
14 different pilot tone hopping sequences the number of pilot
15 tones used in each successive symbol time periods in said
16 portion of said pilot sequence transmission period being
17 the same but the tones used in a symbol time period by any
18 one of the different pilot tone hopping sequences changing
19 in frequency from one symbol time period to the next symbol
20 time period by a frequency shift corresponding to a fixed
21 number of tones, adjacent base stations using different
22 frequency shifts to generate pilot tone hopping sequences
23 with different pilot tone slopes which can be determined
24 from the frequency shift of the pilot tones used in
25 consecutive symbol time periods, the apparatus comprising:
26 a receiver for receiving one or more of said plurality
27 of different pilot tone hopping sequences having different
28 pilot tone slopes ~~each including pilot tones, said pilot~~

29 ~~tones each being generated at a prescribed frequency and~~
30 ~~time instants in a prescribed time frequency grid; and~~
31 a detector, responsive to said one or more received
32 pilot tone hopping sequences, ~~for detecting~~ said detector
33 including an energy accumulator for generating an
34 accumulated energy measurement for each individual one of
35 the plurality of pilot tone hoping sequences having
36 different slopes over a period including multiple symbol
37 time periods, said detector detecting a ~~the~~ received pilot
38 tone hopping sequence having ~~strongest power~~ the maximum
39 accumulated energy over said period including multiple
40 symbol time periods.

1 Claim 2 (currently amended): The invention as defined in
2 claim 1 wherein each of said one or more received pilot
3 tone hopping sequences is a Latin Squares based pilot tone
4 hopping sequence.

1 Claim 3 (currently amended): The invention as defined in
2 claim 1 wherein said receiver yields a baseband version of
3 a received signal and further ~~including~~ includes a unit for
4 generating a fast Fourier transform version of said
5 baseband signal, and wherein said detector is supplied with
6 said fast Fourier transform version of said baseband signal
7 to ~~determine a~~ detect, based on accumulated energy
8 measurements, the received pilot tone sequence having the
9 ~~strongest power~~ maximum accumulated energy.

1 Claim 4 (original): The invention as defined in claim 3
2 wherein said receiver further includes a quantizer for
3 quantizing the results of said fast Fourier transform.

1 Claim 5 (original): The invention as defined in claim 3
2 wherein said detector is a maximum energy detector.

1 Claim 6 (currently amended): The invention as defined in
2 claim 5, wherein different initial frequency shifts are
3 possible for different pilot tone hopping sequences having
4 the same slope; and wherein said maximum energy detector
5 determines a slope and an initial frequency shift ~~of~~ for
6 pilot tones in the a detected pilot tone hopping sequence
7 having the maximum accumulated energy ~~strongest power~~.

1 Claim 7 (currently amended): ~~The invention as defined in~~
2 ~~claim 6~~ Apparatus for use in a mobile user unit in an
3 orthogonal frequency division multiplexing (OFDM) based
4 spread spectrum multiple access wireless system comprising:
5 a receiver for receiving one or more pilot tone
6 hopping sequences each including pilot tones, said pilot
7 tones each being generated at a prescribed frequency and
8 time instants in a prescribed time-frequency grid; and
9 a maximum energy detector, responsive to said one or
10 more received pilot tone hopping sequences, for detecting
11 the received pilot tone hopping sequence having the
12 strongest power,
13 wherein said maximum energy detector includes
14 including a slope-shift accumulator for accumulating energy
15 along each possible slope and initial frequency shift of
16 said one or more received pilot tone hopping sequences and
17 generating an accumulated energy signal, a frequency shift
18 accumulator supplied with said accumulated energy signal
19 for accumulating energy along pilot frequency shifts of
20 said one or more received pilot tone hopping sequences, and
21 a maximum detector supplied with an output from said

22 frequency shift accumulator for estimating a slope and
 23 initial frequency shift of the strongest received pilot
 24 tone hopping sequence as a slope and initial frequency
 25 shift corresponding to the ~~he~~ strongest accumulated energy.

1 Claim 8 (original): The invention as defined in claim 7
 2 wherein said accumulated energy is represented by the
 3 signal $J_0(s, b_0)$, where $J_0(s, b_0) = \sum_{t=0}^{N_s-1} |Y(t, st + b_0 \pmod{N})|^2$, and s is
 4 the slope of the pilot signal, b_0 is an initial frequency
 5 shift of the pilot signal, $Y(t, n)$ is the fast Fourier
 6 transform data, $t = 0, \dots, N_s - 1$, $n = st + b_0 \pmod{N}$, and $n =$
 7 $0, \dots, N - 1$.

1 Claim 9 (original): The invention as defined in claim 7
 2 wherein said frequency shift accumulator
 3 accumulates energy along pilot frequency shifts of said one
 4 or more received pilot tone hopping sequences in accordance
 5 with $J(s, b_0) = \sum_{j=1}^{N_p} J_0(s, b_0 + n_j)$, where s is the slope of the pilot
 6 signal, b_0 is an initial frequency shift of the pilot signal
 7 and n_j are frequency offsets.

1 Claim 10 (original): The invention as defined in claim 7
 2 wherein said maximum detector estimates said slope and
 3 initial frequency shift of the strongest received pilot
 4 tone hopping sequence in accordance with $\hat{s}, \hat{b}_0 = \arg \max_{s, b_0} J(s, b_0)$,
 5 where \hat{s} is the estimate of the slope, \hat{b}_0 is the estimate of

6 the initial frequency shift, and where the maximum is taken
7 over $s \in S$ and $b_0 = 0, \dots, N-1$.

1 Claim 11 (currently amended): ~~The invention as defined in~~
2 ~~claim 6 wherein~~ Apparatus for use in a mobile user unit in
3 an orthogonal frequency division multiplexing (OFDM) based
4 spread spectrum multiple access wireless system comprising:
5 a receiver for receiving one or more pilot tone
6 hopping sequences each including pilot tones, said pilot
7 tones each being generated at a prescribed frequency and
8 time instants in a prescribed time-frequency grid; and
9 a maximum energy detector, responsive to said one or
10 more received pilot tone hopping sequences, for detecting
11 the received pilot tone hopping sequence having the
12 strongest power, said maximum energy detector includes
13 including a frequency shift detector for estimating at a
14 given time frequency shift of the received pilot tone
15 hopping sequence having strongest energy and an estimated
16 maximum energy value, and a slope and frequency shift
17 solver, responsive to said estimated frequency shift and
18 said estimated maximum energy value, for generating
19 estimates of an estimated slope and an estimated initial
20 frequency shift of the strongest received pilot signal.

1 Claim 12 (original): The invention as defined in claim 11
2 wherein said estimated frequency shift at time t is
3 obtained in accordance with $n(t) = st + b_0 \pmod{N}$, where s is the
4 pilot signal slope, t is a symbol time and $n(t)$ is a
5 frequency shift estimate.

1 Claim 13 (original): The invention as defined in claim 12
 2 wherein said estimated maximum energy value is obtained in
 3 accordance with $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} |Y(t, n + n_j \pmod{N})|^2$, where $E(t)$
 4 is the maximum energy value, $Y(t, n)$ is the fast Fourier
 5 transform data, $j = 1, \dots, N_p$ and n_j are frequency offsets.

1 Claim 14 (original): The invention as defined in claim 13
 2 wherein said slope is estimated in accordance with
 3 $\hat{s} = \arg \max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) 1_{\{n(t) - n(t-1) = s\}}$, where both $n(t)$ and $n(t-1)$
 4 satisfy $n(t) = st + b_0 \pmod{N}$.

1 Claim 15 (original): The invention as defined in claim 13
 2 wherein said frequency shift is estimated in accordance
 3 with $\hat{b}_0 = \arg \max_{b_0=0, \dots, N-1} \sum_{t=0}^{N_n-1} E(t) 1_{\{n(t) = st + b_0\}}$.

1 Claim 16 (original): The invention as defined in claim 11
 2 wherein said maximum energy detector detects said slope in
 3 accordance with determining the time, $t_0 \in T$, and slope, $s_0 \in S$,
 4 such that the set of times t on the line $n(t) = n(t_0) + s_0(t - t_0)$,
 5 has the largest total pilot signal energy.

1 Claim 17 (currently amended): A method for use in a mobile
 2 user unit in an orthogonal frequency division multiplexing
 3 (OFDM) based spread spectrum multiple access wireless
 4 system including at least two adjacent base stations, each
 5 one of the adjacent base stations transmitting pilot tones
 6 according to one of a plurality of different pilot tone

7 hopping sequences, in each of the different pilot tone
8 hopping sequences over at least a portion of a pilot
9 sequence transmission time period, said portion including
10 multiple symbol time periods, the number of pilot tones
11 used in each successive symbol time period in said portion
12 of said pilot sequence transmission time period being the
13 same but the tones used in a symbol time period by any one
14 of the different pilot tone hopping sequences changing in
15 frequency from one symbol time period to the next symbol
16 time period by a frequency shift corresponding to a fixed
17 number of tones, adjacent base stations using different
18 frequency shifts to generate pilot tone hopping sequences
19 with different pilot tone slopes which can be determined
20 from the frequency shift of the pilot tones used in
21 consecutive symbol time periods, the method comprising the
22 steps of:

23 receiving one or more of said plurality of different
24 pilot tone hopping sequences having different pilot tone
25 hopping slopes ~~each including pilot tones, said pilot tones~~
26 ~~each being generated at a prescribed frequency and time~~
27 ~~instants in a prescribed time frequency grid; and~~
28 in response to said one or more received pilot tone
29 hopping sequences: -

30 generating an accumulated energy measurement for each
31 individual one of the plurality of pilot tone hopping
32 sequences having different pilot tone hopping slopes over a
33 period including multiple symbol time periods; and

34 detecting the a received pilot tone hopping sequence
35 having ~~strongest power~~ the maximum accumulated energy over
36 said period including multiple symbol time periods.

1 Claim 18 (currently amended): The method as defined in
2 claim 17 wherein each of said one or more received pilot
3 tone hopping sequences is a Latin Squares based pilot tone
4 hopping sequence.

1 Claim 19 (currently amended): The method as defined in
2 claim 17 wherein said step of receiving yields a baseband
3 version of a received signal and further including a step
4 of generating a fast Fourier transform version of said
5 baseband signal, and wherein said step of detecting is
6 responsive to said fast Fourier transform version of said
7 baseband signal for ~~determining a~~ detecting the received
8 pilot tone sequence having the maximum accumulated energy
9 ~~strongest power~~.

1 Claim 20 (original): The method as defined in claim 19
2 wherein said step of receiving further includes a step of
3 quantizing the results of said fast Fourier transform.

1 Claim 21 (original): The method as defined in claim 19
2 wherein said step of detecting detects a maximum energy.

1 Claim 22 (currently amended): The method as defined in claim 21
2 wherein said step of detecting said maximum energy includes
3 a step of determining a slope and initial frequency shift
4 of pilot tones in a detected pilot tone hopping sequence
5 having the maximum accumulated energy ~~strongest power~~.

1 Claim 23 (currently amended): ~~The method as defined in~~
2 ~~claim 22 wherein~~ A method for use in a mobile user unit in
3 an orthogonal frequency division multiplexing (OFDM) based

4 spread spectrum multiple access wireless system comprising
 5 the steps of:
 6 receiving one or more pilot tone hopping sequences
 7 each including pilot tones, said pilot tones each being
 8 generated at a prescribed frequency and time instants in a
 9 prescribed time-frequency grid; and
 10 in response to said one or more received pilot tone
 11 hopping sequences, detecting the received pilot tone
 12 hopping sequence having the maximum energy ~~strongest power~~,
 13 said step of detecting said maximum energy includes
 14 including the steps of accumulating energy along each
 15 possible slope and initial frequency shift of said one or
 16 more received pilot tone hopping sequences and generating
 17 an accumulated energy signal, in response to said
 18 accumulated energy signal, accumulating energy along pilot
 19 frequency shifts of said one or more received pilot tone
 20 hopping sequences, and in response to an output from said
 21 step of frequency shift accumulating, estimating a slope
 22 and initial frequency shift of the strongest received pilot
 23 tone hopping sequence as a slope and initial frequency
 24 shift corresponding to ~~he~~ the strongest accumulated energy.

1 Claim 24 (original): The method as defined in claim 23
 2 wherein said accumulated energy is represented by the
 3 signal $J_0(s, b_0)$, where $J_0(s, b_0) = \sum_{t=0}^{N_{st}-1} |Y(t, st + b_0 \pmod{N})|^2$, and s is
 4 the slope of the pilot signal, b_0 is an initial frequency
 5 shift of the pilot signal, $Y(t, n)$ is the fast Fourier
 6 transform data, $t = 0, \dots, N_{st}-1$, $n = st + b_0 \pmod{N}$, and $n =$
 7 $0, \dots, N-1$.

1 Claim 25 (original): The method as defined in claim 23
 2 wherein said step of frequency shift accumulating includes
 3 a step of accumulating energy along pilot frequency shifts
 4 of said one or more received pilot tone hopping sequences
 5 in accordance with $J(s, b_0) = \sum_{j=1}^{N_f} J_0(s, b_0 + n_j)$, where s is the slope
 6 of the pilot signal, b_0 is an initial frequency shift of the
 7 pilot signal and n_j are frequency offsets.

1 Claim 26 (original): The method as defined in claim 23
 2 wherein said step of maximum energy detecting includes a
 3 step of estimating said slope and initial frequency shift
 4 of the strongest received pilot tone hopping sequence in
 5 accordance with $\hat{s}, \hat{b}_0 = \arg \max_{s, b_0} J(s, b_0)$, where \hat{s} is the estimate of
 6 the slope, \hat{b}_0 is the estimate of the initial frequency
 7 shift, and where the maximum is taken over
 8 $s \in S$ and $b_0 = 0, \dots, N-1$.

1 ~~Claim 27 (currently amended): The method as defined in~~
 2 ~~claim 22 wherein~~ A method for use in a mobile user unit in
 3 an orthogonal frequency division multiplexing (OFDM) based
 4 spread spectrum multiple access wireless system comprising
 5 the steps of:
 6 receiving one or more pilot tone hopping sequences
 7 each including pilot tones, said pilot tones each being
 8 generated at a prescribed frequency and time instants in a
 9 prescribed time-frequency grid; and
 10 in response to said one or more received pilot tone
 11 hopping sequences, detecting the received pilot tone
 12 hopping sequence having maximum energy, ~~strongest power,~~

13 said step of ~~maximum energy~~ detecting the received pilot
 14 tone hopping sequence having maximum energy including
 15 ~~includes~~ a step of estimating, at a given time, a frequency
 16 shift of the received pilot tone hopping sequence having
 17 ~~strongest~~ maximum energy and estimating a maximum energy
 18 value, and in response to said estimated frequency shift
 19 and said estimated maximum energy value, generating
 20 estimates of an estimated slope and an estimated initial
 21 frequency shift of the strongest received pilot signal.

1 Claim 28 (original): The method as defined in claim 27
 2 wherein said estimated frequency shift at time t is
 3 obtained in accordance with $n(t) = st + b_0 \pmod{N}$, where s is the
 4 pilot signal slope, t is a symbol time and $n(t)$ is a
 5 frequency shift estimate.

1 Claim 29 (original): The method as defined in claim 28
 2 wherein said estimated maximum energy value is obtained in
 3 accordance with $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} |Y(t, n + n_j \pmod{N})|^2$, where $E(t)$
 4 is the maximum energy value, $Y(t, n)$ is the fast Fourier
 5 transform data, $j = 1, \dots, N_p$ and n_j are frequency offsets.

1 Claim 30 (original): The method as defined in claim 29
 2 wherein said slope is estimated in accordance with
 3 $\hat{s} = \arg \max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) 1_{\{n(t) - n(t-1) = s\}}$, where both $n(t)$ and $n(t-1)$
 4 satisfy $n(t) = st + b_0 \pmod{N}$.

1 Claim 31 (original): The method as defined in claim 29
 2 wherein said frequency shift is estimated in accordance

3 with $\hat{b}_0 = \arg \max_{b_0=0, \dots, N-1} \sum_{t=0}^{N_s-1} E(t) 1_{\{n(t)=st+b_0\}}$.

1 Claim 32 (original): The method as defined in claim 27
 2 wherein said step of maximum energy detecting includes a
 3 step of finding the time, $t_0 \in T$, and slope, $s_0 \in S$, such that
 4 the set of times t on the line $n(t) = n(t_0) + s_0(t - t_0)$, has the
 5 largest total pilot signal energy.

1 Claim 33 (currently amended): Apparatus for use in a
 2 mobile user unit in an orthogonal frequency division
 3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system including at least two adjacent base
 5 stations, each one of the adjacent base stations
 6 transmitting pilot tones according to one of a plurality of
 7 different pilot tone hopping sequences over at least a
 8 portion of a pilot sequence transmission time period, said
 9 portion including multiple symbol time periods, at least
 10 one of the different pilot tone hopping sequences including
 11 at least two pilot tones per symbol time period which are
 12 separated from one another by at least one tone during said
 13 portion of said pilot sequence transmission time period, in
 14 each of the different pilot tone hopping sequences the
 15 number of pilot tones used in each successive symbol time
 16 period in said portion of said pilot sequence transmission
 17 time period being the same but the tones used in a symbol
 18 time period by any one of the different pilot tone hopping
 19 sequences changing in frequency from one symbol time period
 20 to the next symbol time period by a frequency shift

21 corresponding to a fixed number of tones, adjacent base
22 stations using different frequency shifts to generate pilot
23 tone hopping sequences with different pilot tone slopes
24 which can be determined from the frequency shift of the
25 pilot tones used in consecutive symbol time periods, the
26 apparatus comprising the steps of:

27 means for receiving one or more of said different
28 pilot tone hopping sequences each including pilot tones,
29 ~~said pilot tones each being generated at a prescribed~~
30 ~~frequency and time instants in a prescribed time frequency~~
31 ~~grid; and~~

32 means, responsive to said one or more received pilot
33 tone hopping sequences, for generating an accumulated
34 energy measurement for each individual one of the plurality
35 of different pilot tone hopping sequences having different
36 pilot tone slopes; and

37 detector means for detecting a ~~the~~ received pilot
38 tone hopping sequence having ~~strongest power~~ the maximum
39 accumulated energy over a period including multiple symbol
40 time periods.

1 Claim 34 (currently amended): The invention as defined in
2 claim 33 wherein each of said one or more received pilot
3 tone hopping sequences is a Latin Squares based pilot tone
4 hopping sequence.

1 Claim 35 (currently amended): The invention as defined in
2 claim 33 wherein said means for receiving yields a baseband
3 version of a received signal and further including means
4 for generating a fast Fourier transform version of said
5 baseband signal, and wherein said means for detecting is
6 responsive to said fast Fourier transform version of said

7 baseband signal for determining a received pilot tone
8 sequence having the maximum energy ~~strongest power~~.

1 Claim 36 (original): The invention as defined in claim 35
2 wherein said means for generating said fast Fourier
3 transform includes means for quantizing the results of said
4 fast Fourier transform.

1 Claim 37 (original): The invention as defined in claim 35
2 wherein means for detecting detects a maximum energy.

1 Claim 38 (currently amended): The invention as defined in
2 claim 37 wherein said means for detecting said maximum
3 energy includes means for determining a slope and an
4 initial frequency shift of pilot tones in a detected pilot
5 tone hopping sequence having the maximum energy ~~strongest~~
6 ~~power~~.

1 Claim 39 (currently amended): ~~The invention as defined in~~
2 ~~claim 38 wherein~~ Apparatus for use in a mobile user unit in
3 an orthogonal frequency division multiplexing (OFDM) based
4 spread spectrum multiple access wireless system comprising
5 the steps of:
6 means for receiving one or more pilot tone hopping
7 sequences each including pilot tones, said pilot tones each
8 being generated at a prescribed frequency and time instants
9 in a prescribed time-frequency grid; and
10 means, responsive to said one or more received pilot
11 tone hopping sequences, for detecting the received pilot
12 tone hopping sequence having maximum energy, said means for
13 detecting said maximum energy including ~~includes~~ means for
14 accumulating energy along each possible slope and initial

15 frequency shift of said one or more received pilot tone
 16 hopping sequences, means for generating an accumulated
 17 energy signal, means, responsive to said accumulated energy
 18 signal, for accumulating energy along pilot frequency
 19 shifts of said one or more received pilot tone hopping
 20 sequences, and means, responsive to an output from said
 21 means for frequency shift accumulating, for estimating a
 22 slope and an initial frequency shift of the strongest
 23 received pilot tone hopping sequence as a the slope and the
 24 initial frequency shift corresponding to ~~he~~ the strongest
 25 accumulated energy.

1 Claim 40 (original): The invention as defined in claim 39
 2 wherein said accumulated energy is represented by the
 3 signal $J_0(s, b_0)$, where $J_0(s, b_0) = \sum_{t=0}^{N_s-1} |Y(t, st + b_0 \pmod{N})|^2$, and s is
 4 the slope of the pilot signal, b_0 is an initial frequency
 5 shift of the pilot signal, $Y(t, n)$ is the fast Fourier
 6 transform data, $t = 0, \dots, N_s - 1$, $n = st + b_0 \pmod{N}$, and $n =$
 7 $0, \dots, N - 1$.

1 Claim 41 (original): The invention as defined in claim 39
 2 wherein said means for frequency shift accumulating
 3 includes means for accumulating energy along pilot
 4 frequency shifts of said one or more received pilot tone
 5 hopping sequences in accordance with $J(s, b_0) = \sum_{j=1}^{N_p} J_0(s, b_0 + n_j)$,
 6 where s is the slope of the pilot signal, b_0 is an initial
 7 frequency shift of the pilot signal and n_j are frequency
 8 offsets.

1 Claim 42 (original): The invention as defined in claim 39
 2 wherein said means for maximum energy detecting includes
 3 means for estimating said slope and initial frequency shift
 4 of the strongest received pilot tone hopping sequence in
 5 accordance with $\hat{s}, \hat{b}_0 = \arg \max_{s, b_0} J(s, b_0)$, where \hat{s} is the estimate of
 6 the slope, \hat{b}_0 is the estimate of the initial frequency
 7 shift, and where the maximum is taken over
 8 $s \in S$ and $b_0 = 0, \dots, N-1$.

1 Claim 43 (currently amended): ~~The invention as defined in~~
 2 ~~claim 37 wherein~~
 3 Apparatus for use in a mobile user unit in an orthogonal
 4 frequency division multiplexing (OFDM) based spread
 5 spectrum multiple access wireless system comprising the
 6 steps of:
 7 means for receiving one or more pilot tone hopping
 8 sequences each including pilot tones, said pilot tones each
 9 being generated at a prescribed frequency and time instants
 10 in a prescribed time-frequency grid; and
 11 means, responsive to said one or more received pilot
 12 tone hopping sequences, for detecting the received pilot
 13 tone hopping sequence having maximum energy, ~~strongest~~
 14 ~~power~~ said means for ~~maximum energy~~ detecting said maximum
 15 energy including ~~includes~~ means for estimating at a given
 16 time a frequency shift of the received pilot tone hopping
 17 sequence having ~~strongest~~ maximum energy and for estimating
 18 a maximum energy value, and means, responsive to said
 19 estimated frequency shift and said estimated maximum energy
 20 value, for generating estimates of an estimated slope and

21 an estimated initial frequency shift of the strongest
22 received pilot signal.

1 Claim 44 (original): The invention as defined in claim 43
2 wherein said estimated frequency shift at time t is
3 obtained in accordance with $n(t) = st + b_0 \pmod{N}$, where s is the
4 pilot signal slope, t is a symbol time and $n(t)$ is a
5 frequency shift estimate.

1 Claim 45 (original): The invention as defined in claim 44
2 wherein said estimated maximum energy value is obtained in
3 accordance with $[E(t), n(t)] = \max_n \sum_{j=1}^{N_p} |Y(t, n + n_j \pmod{N})|^2$, where $E(t)$
4 is the maximum energy value, $Y(t, n)$ is the fast Fourier
5 transform data, $j = 1, \dots, N_p$ and n_j are frequency offsets.

1 Claim 46 (original): The invention as defined in claim 45
2 wherein said slope is estimated in accordance with

$$3 \quad \hat{s} = \arg \max_{s \in S} \sum_{t=1}^{N_{sy}-1} E(t) \mathbf{1}_{\{n(t) - n(t-1) = s\}}, \text{ where both } n(t) \text{ and } n(t-1)$$

4 satisfy

$$1 \quad n(t) = st + b_0 \pmod{N}.$$

1 Claim 47 (original): The invention as defined in claim 45
2 wherein said frequency shift is estimated in accordance

$$3 \quad \text{with } \hat{b}_0 = \arg \max_{b_0=0, \dots, N-1} \sum_{t=0}^{N_n-1} E(t) \mathbf{1}_{\{n(t) = st + b_0\}}.$$

1 Claim 48 (original): The invention as defined in claim 43
2 wherein said means for detecting maximum energy includes

3 means for finding the time, $t_0 \in T$, and slope, $s_0 \in S$, such that
4 the set of times t on the line $n(t) = n(t_0) + s_0(t - t_0)$, has the
5 largest total pilot signal energy.

1 49 (New) The method of claim 1, wherein frequency spacing
2 between pilot tones which occur in a symbol time period in
3 each of said plurality of tone hopping sequences is fixed
4 and is the same for all of said plurality of pilot tone
5 hopping sequences.

1 50. (New) An orthogonal frequency division multiplexing
2 (OFDM) based spread spectrum multiple access wireless
3 system comprising:
4 at least two adjacent base stations, each one of the
5 adjacent base stations transmitting pilot tones according
6 to one of a plurality of different pilot tone hopping
7 sequences over at least a portion of a pilot sequence
8 transmission time period, said portion including multiple
9 symbol time periods, at least one of the different pilot
10 tone hopping sequences including at least two pilot tones
11 per symbol time period which are separated from one another
12 by at least one tone during said portion of said pilot
13 sequence transmission time period, in each of the different
14 pilot tone hopping sequences the number of pilot tones used
15 in each successive symbol time period in said portion of
16 said pilot sequence transmission period being the same but
17 the tones used in a symbol time period by any one of the
18 different pilot tone hopping sequences changing in
19 frequency from one symbol time period to the next symbol
20 time period by a frequency shift corresponding to a fixed
21 number of tones, adjacent base stations using different

22 frequency shifts to generate pilot tone hopping sequences
23 with different pilot tone slopes which can be determined
24 from the frequency shift of the pilot tones used in
25 consecutive symbol time periods; and
26 a mobile communications device including:
27 i) a receiver for receiving one or more of said
28 plurality of different pilot tone hopping sequences; and
29 ii) means for determining the pilot tone slope of
30 a received pilot tone hopping sequence.

1 51. (New) An orthogonal frequency division multiplexing
2 (OFDM) based spread spectrum multiple access wireless
3 communications method, comprising:
4 at least two adjacent bases stations which transmit
5 pilot tones according to different ones of a plurality of
6 different pilot tone hopping sequences over at least a
7 portion of a pilot sequence transmission time period, said
8 portion including multiple symbol time periods, at least
9 one of the different pilot tone hopping sequences including
10 at least two pilot tones per symbol time period which are
11 separated from one another by at least one tone during said
12 portion of said pilot sequence transmission time period, in
13 each of the different pilot tone hopping sequences the
14 number of pilot tones used in each successive symbol time
15 period in said portion of said pilot sequence transmission
16 period being the same but the tones used in a symbol time
17 period by any one of the different pilot tone hopping
18 sequences changing in frequency from one symbol time period
19 to the next symbol time period by a frequency shift
20 corresponding to a fixed number of tones, each of the
21 adjacent base stations using different frequency shifts to
22 generate the transmitted pilot tone hopping sequences

23 resulting in different pilot tone slopes which can be
24 determined from the frequency shift of the pilot tones
25 transmitted in consecutive symbol time periods.

1 52. (New) The method of claim 51, wherein frequency spacing
2 between pilot tones which occur in a symbol time period in
3 each of said plurality of tone hopping sequences is fixed
4 and is the same for all of said plurality of pilot tone
5 hopping sequences.